Office of Energy Efficiency and Renewable Energy

Rapid Prototyping Speeds Use of Lightweight Materials

Background

Auto manufacturers are seeking lightweight materials that are strong enough to replace conventional materials for body, chassis, and powertrain applications in advanced light-duty vehicles. Researchers have found materials that can reduce vehicle weight by more that 60%, but so far, the cost of these materials, the ability of engineers to design cars with them, and the processes required to manufacture them are inadequate for high-volume production of safe, durable, recyclable, and affordable automobiles.

The Lightweight Vehicle Materials Program, part of the U.S. Department of Energy's Office of Advanced Automotive Technologies (OAAT), is working with the automotive industry – through the U.S. Automotive Materials Partnership (USAMP) – to develop test-bed vehicles that are 50% lighter than conventional vehicles.

Accomplishments

- An USAMP project has reduced the die development time for metal molding processes from 12 to 3 months. The team produced a hard, functional tooling die insert in only 7-1/2 weeks, compared with the normal 48-52 weeks, at a much reduced tooling cost. The die insert was evaluated during a 3,000-piece die casting run of an aluminum torque converter.

Benefits

- The ability to easily, inexpensively, and rapidly produce prototypes as die castings allows automotive engineers to verify designs that will minimize the weight of the component and ensure that the designs meet engineering requirements.
- The significant reduction in lead time and tooling costs will increase use of aluminum die castings, which are less expensive to produce than forged or fabricated components.

Rapid Die Development Process

- These processing improvements can accelerate the introduction of lightweight materials and lead to dramatic improvements in automobile fuel efficiency, thereby reducing the nation's reliance on foreign oil and minimizing adverse environmental impacts.
- The substantial reduction in lead time and costs will significantly improve the international competitiveness of the U.S. auto industry.

Future Activities

- Improve cost, performance, manufacturability, safety, and recylability of both metals and composites.
- Identify a range of lightweight materials that can be produced in the quantities and with the robustness needed for automotive use, at life-cycle costs comparable to those of current materials.

Partners in Success

USCAR's U.S. Automotive Materials Partnership (DaimlerChrysler Corporation, Ford Motor Company, General Motors Corporation)

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